

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Reissue application of: **U.S. Patent No. 5,924,398**

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Inventor: Michael Choi

Original Patent Application Filing Date: October 6, 1997

For: **FLOW IMPROVEMENT VANES IN THE INTAKE SYSTEM OF AN  
INTERNAL COMBUSTION ENGINE**

Attorney Docket No.: FMC 1305 R

**PRELIMINARY AMENDMENT**

Commissioner for Patents  
United States Patent and Trademark Office  
Washington, D.C. 20231

Sir:

Prior to examination, please amend the above-identified reissue application as follows:

**In The Specification**

Please amend the paragraph in column 1, beginning at line 25 as follows:

As for noise generation, this portion of the air intake system has generally been made of metal. However, in today's vehicles, an emphasis is placed on fuel economy and exhaust emissions reductions. This has lead to the desire to form the intake manifold and possibly even the throttle body out of plastic types of materials. Plastic [arts] parts can be formed which are lighter in weight and can be formed into more complex shapes than equivalent metal parts, allowing for improved air flow and thus improving both fuel economy and engine performance.

**CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.10**

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DAVID S. BIR  
Name of Person Signing

  
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**Please amend the paragraph in column 3, beginning at line 7 as follows:**

A further advantage of the present invention is that [contaminate] contaminant laden EGR gasses will not backflow to the downstream side of the throttle valve, thus reducing the chance for unwanted sludge to build up and cause a throttle valve sticking condition.

**Please amend the paragraph in column 5, beginning at line 45 as follows:**

When the air flows past the partially open throttle plate, a high velocity turbulent air flow is created by the pressure drop across the throttle plate 28. As the air flows between the vanes 62,64, the vanes 62,64 will diffuse and redirect the air flow [patter] pattern such that the air creates small vortices of turbulence around each vane, but with each adjacent vorticity rotating in the opposite direction, thus canceling each other out. This reduces the noise created, which reduces the noise radiated from the intake manifold 24. So, proper spacing depends upon getting effective canceling out of vortices as opposed to random spacing which may just cause turbulence in the air flow.

**Please amend the paragraph in column 5, beginning at line 57 as follows:**

Generally the whoosh noise generated is the greatest at tip-in or fast opening of the throttle plate and also at part throttle cruising/tip-in conditions, which can be mistaken by a driver for a vacuum leak on the engine. Thus, with this new air flow pattern, the whoosh noise generated from the air flow will be attenuated, consequently reducing the overall noise passing through the [stake] intake manifold 24 and into the engine compartment. Again, the amount of noise attenuation improvement due to an increase in the size of the vanes must be balanced against the amount of flow loss (and hence horsepower loss) due to the vanes being in the air stream.

**Please amend the paragraph in column 6, beginning at line 1 as follows:**

Another effect of the diffusing and redirecting of the air flow by the vanes 62,64 is that any backflow from the swirling air just downstream of the butterfly valve 28 will be reduced. Thus, some of the inlet air that might otherwise be drawn back against the downstream side of the butterfly valve 28 will continue flowing downstream into the manifold 24. For this manifold assembly, where it is desirable to locate the EGR inlet 68 close to the upstream end of the intake manifold 24, some of the EGR gasses can become entrained in the inlet air which is drawn back to the downstream side of the butterfly valve 28. Since the EGR gasses are likely to contain [contaminates] contaminants, these can settle on the butterfly valve 28 and downstream portion of the throttle body main bore 26 to form sludge. Consequently, the vanes 62,64, by diffusing and redirecting the inlet air, will significantly reduce the amount of backflow and hence the risk of [contaminates] contaminants from the EGR gasses causing build up of sludge on and a sticking condition of the butterfly valve 28.

**Please amend the paragraph in column 7, beginning at line 35 as follows:**

FIG. 11 illustrates a seventh embodiment of the present invention. This air diffuser 720 is used in place of the air diffuser 20, illustrated in FIG. 1, for this embodiment. In this seventh embodiment, similar elements are similarly designated, but with **700** series numbers. The upper set of parallel vanes and the lower set of parallel vanes are really now just one [continues] continuous set of vertical vanes 762, along with the addition of parallel horizontal vanes 68. This forms a full grid pattern of vanes. The thickness of these vanes is constant along the length of the vanes. While the full grid pattern is most effective for diffusing and redirecting the air flow and thus for attenuation of the noise, there are very substantial flow losses created due to the significant amount of blockage of the main bore 752. This blockage will thus significantly reduce the maximum horsepower of the engine.

## **In The Claims**

Please add claims 21-53 as follows:

21. (Added) An air intake system for controlling the flow of air into an internal combustion engine, the air intake system comprising an intake manifold having a bore wall defining a main bore for receiving airflow, the bore wall including a plurality of vanes extending into the main bore for reducing noise emanating from the intake system associated with airflow through the intake system.

22. (Added) An air intake system for a fuel injected internal combustion engine including a throttle body having a throttle valve for controlling airflow through a main bore in fluid communication with an air intake manifold wherein at least one of the throttle body and the air intake manifold include an air diffuser positioned downstream of the throttle valve in the main bore to reduce noise created by air flowing past the throttle valve.

23. (Added) The air intake system of claim 22 wherein the air diffuser comprises at least one vane spanning the main bore.

24. (Added) The air intake system of claim 23 wherein the at least one vane comprises a plurality of parallel vanes spanning the main bore.

25. (Added) An air intake system for a fuel injected internal combustion engine including a throttle body, an air intake manifold, and an air diffuser arranged in the intake system downstream of the throttle body and upstream of a plurality of fuel injectors for reducing noise emanating from the intake system, the air diffuser having a main bore defined by a bore wall and a set of vanes substantially equally spaced from one another and extending from a portion of the bore wall into the main bore.

26. (Added) An air intake system for a fuel injected internal combustion engine including a throttle body, an air intake manifold, and an air diffuser arranged in the intake manifold downstream of the throttle body and upstream of a plurality of fuel injectors

for reducing noise emanating from the intake system, the air diffuser having a main bore defined by a bore wall and a plurality of radial vanes extending from at least a portion of the bore wall into the main bore.

27. (Added) An air intake system for a fuel injected internal combustion engine including a throttle body, an air intake manifold, and an air diffuser arranged in the intake system to reduce noise emanating from the intake system due to air flowing through the throttle body, the air diffuser having a main bore defined by a bore wall and a first set of vanes spaced from one another and extending parallel to one another from a portion of the bore wall into the main bore, and a second set of vanes spaced from one another and extending parallel to one another from a different portion of the bore wall than the first set into the main bore.

28. (Added) The air intake system of claim 27 wherein the air diffuser comprises a separable component mounted between the throttle body and the air intake manifold.

29. (Added) The air intake system of claim 27 wherein the air diffuser comprises a plate having an upstream face and a downstream face with the vanes extending beyond the face of at least one of the upstream and downstream faces.

30. (Added) An air intake system for a fuel injected internal combustion engine including a throttle body having a first bore wall defining a first portion of a main bore and a throttle valve for controlling airflow through the main bore, an air intake manifold in fluid communication with the throttle body and including a second bore wall defining a second portion of the main bore, the air intake system comprising an air diffuser disposed downstream of the throttle valve and having at least one vane extending across the main bore connecting to two locations of the bore wall to reduce noise associated with air flowing past the throttle valve.

31. (Added) An air intake system for a fuel injected internal combustion engine including a throttle body having a first bore wall defining a first portion of a main bore and a throttle valve for controlling airflow through the main bore, an air intake manifold in fluid communication with the throttle body and including a second bore wall defining a second portion of the main bore, the air intake system comprising a diffuser having a grid pattern for diffusing and redirecting air flowing through the main bore to reduce noise emanating through the intake system associated with air flowing past the throttle valve.

32. (Added) An air intake system for a fuel injected internal combustion engine including a throttle body having a first bore wall defining a first portion of a main bore and a throttle valve for controlling airflow through the main bore, an air intake manifold in fluid communication with the throttle body and including a second bore wall defining a second portion of the main bore, the air intake system having means for diffusing and redirecting air flowing through the main bore to reduce noise associated with air flowing past the throttle valve.

33. (Added) An air intake system for controlling the flow of air into an internal combustion engine comprising:

a throttle body including a first bore wall defining a first portion of a main bore and a valve mounted within the first portion of the main bore with the valve being movable to selectively restrict flow of air through the main bore;

an intake manifold including a second bore wall defining a second portion of the main bore, with the second bore wall having an upstream end, and the manifold further including means for mounting the throttle body relative to the intake manifold such that the first and the second portions of the main bore align with one another, with the intake manifold being downstream of the throttle body, and with the manifold including an EGR inlet adjacent the upstream end of the second bore wall; and

a plurality of vanes spaced from one another disposed downstream of the valve and extending into the main bore to reduce sound generated within the intake system associated with air flowing past the valve.

34. (Added) The air intake system of claim 33 wherein the plurality of vanes extends from the first bore wall.

35. (Added) The air intake system of claim 33 wherein the plurality of vanes extends from the second bore wall.

36. (Added) The air intake system of claim 33 further comprising an air diffuser positioned between the throttle body and the intake manifold, the air diffuser having a third bore wall defining a third portion of the main bore wherein the plurality of vanes extends from the third bore wall into the third portion of the main bore.

37. (Added) A method for use in a fuel injected internal combustion engine having a throttle body with a throttle valve for selectively restricting airflow therethrough, an intake manifold, and a plurality of fuel injectors for injecting fuel into the air downstream of the throttle valve, the method comprising:

redirecting air flowing past the intake throttle using a plurality of vanes extending into the airflow downstream of the throttle valve to reduce noise associated with the air flowing past the throttle valve.

38. (Added) A method for use in a fuel injected internal combustion engine having a throttle body with a throttle valve for selectively restricting airflow therethrough, an intake manifold, and a plurality of fuel injectors for injecting fuel into the air downstream of the throttle valve, the method comprising:

redirecting air flowing past the intake throttle using a plurality of substantially evenly spaced parallel vanes extending into the airflow downstream of the throttle valve and upstream of the intake manifold to reduce noise associated with the air flowing past the throttle valve.

39. (Added) A method for use in a fuel injected internal combustion engine having a throttle body with a throttle valve for selectively restricting airflow through an intake passage, an intake manifold, and a plurality of fuel injectors for injecting fuel into the air

downstream of the throttle valve, the method comprising:

redirecting air flowing past the throttle valve using a diffusing element spanning the intake passage downstream of the throttle valve and upstream of the intake manifold to reduce noise associated with the air flowing past the throttle valve.

40. (Added) A method for use in a fuel injected internal combustion engine having a throttle body with a throttle valve for selectively restricting airflow through an intake passage, an intake manifold, and a plurality of fuel injectors for injecting fuel into the air downstream of the throttle valve, the method comprising:

redirecting air flowing past the throttle valve using a plurality of diffusing elements arranged in a grid pattern spanning the intake passage downstream of the throttle valve and upstream of the intake manifold to reduce noise associated with the air flowing past the throttle valve.

41. (Added) A method for use in a fuel injected internal combustion engine having a throttle body with a throttle valve for selectively restricting airflow through an intake passage, an intake manifold, and a plurality of fuel injectors for injecting fuel into the air downstream of the throttle valve, the method comprising:

modifying airflow past the throttle valve using a diffusing element having a grid pattern and extending across the intake passage downstream of the throttle valve and upstream of the fuel injectors to reduce noise associated with the air flowing past the throttle valve.

42. (Added) An air diffuser for use with an air intake system of a fuel injected internal combustion engine having a throttle body and an air intake manifold, the air diffuser comprising:

a body defining an air passage and adapted for mounting between the throttle body and the intake manifold; and

a plurality of vanes extending from the body into the air passage to redirect air flowing through the passage and reduce associated noise.



43. (Added) An air diffuser for use with an air intake system of a fuel injected internal combustion engine having a throttle body and an air intake manifold, the air diffuser comprising:

a body defining an air passage and adapted for mounting between the throttle body and the intake manifold; and

a plurality of vanes spaced from one another and extending from the body into the air passage to redirect air flowing through the passage and reduce associated noise.

44. (Added) The air diffuser of claim 43 wherein the plurality of vanes spans the air passage.

45. (Added) The air diffuser of claim 44 wherein the plurality of vanes are substantially parallel.

46. (Added) The air diffuser of claim 44 wherein the plurality of vanes forms a grid pattern.

47. (Added) The air diffuser of claim 43 wherein at least some of the plurality of vanes extend inward from the body toward a center of the air passage.

48. (Added) The air diffuser of claim 43 wherein the body defines a substantially circular air passage.

49. (Added) The air diffuser of claim 43 wherein at least some of the plurality of vanes taper as they extend into the air passage.

50. (Added) An air diffuser for use with an air intake system of an internal combustion engine including a throttle body and an air intake manifold, the air diffuser comprising:

a body adapted for mounting between the throttle body and the air intake manifold, the body having a main passage for accommodating airflow from the throttle body

to the air intake manifold;

a first set of vanes spaced from one another and extending from a first portion of the body into the main passage;

a second set of vanes spaced from one another and extending from a second portion of the body into the main passage, wherein an average length of the first set of vanes is less than an average length of the second set of vanes.

51. (Added) An air intake system for controlling the flow of air into a fuel injected internal combustion engine having a plurality of fuel injectors, the air intake system comprising an intake manifold having a wall defining a main air passage for receiving airflow, the wall including a diffusing element within the main air passage upstream of the plurality of fuel injectors for reducing noise emanating from the intake system associated with airflow through the intake system.

52. (Added) An air intake system for controlling the flow of air into an internal combustion engine, the air intake system comprising an intake manifold having a wall defining a main air passage for receiving airflow, the wall including a plurality of parallel vanes extending into the main bore for reducing noise emanating from the intake system associated with airflow through the intake system.

53. (Added) An air intake system for controlling the flow of air into an internal combustion engine including an EGR circuit for selectively diverting a portion of exhaust gas to the intake system via an EGR inlet, the air intake system comprising an intake manifold having a wall defining a main air passage for receiving airflow, the wall including an integral air diffuser extending into the main bore upstream of the EGR inlet for reducing noise emanating from the intake system associated with airflow through the intake system and reducing upstream flow of EGR gases.

54. (Added) A method for use in a fuel injected internal combustion engine having a throttle body with a throttle valve for selectively restricting airflow therethrough, an intake manifold, and a plurality of fuel injectors for injecting fuel into the air downstream of

the throttle valve, the method comprising:

modifying airflow through the intake using a plurality of vanes extending into the airflow downstream of the throttle valve to reduce noise associated with the air flowing past the throttle valve.

55. (Added) A method for use in a fuel injected internal combustion engine having a plastic throttle body with a throttle valve for selectively restricting airflow therethrough, a plastic intake manifold, and a plurality of fuel injectors for injecting fuel into the air downstream of the throttle valve, the method comprising:

modifying airflow through the plastic throttle body using a plurality of substantially evenly spaced parallel vanes integrally formed in the throttle body and extending into the airflow downstream of the throttle valve and upstream of the intake manifold to reduce noise associated with the air flowing past the throttle valve.

56. (Added) An air intake system for controlling the flow of air into a fuel injected internal combustion engine, the system comprising:

a plastic throttle body including a first wall defining a first portion of a main air passage and a valve mounted within the first portion of the main air passage with the valve being movable to selectively restrict flow of air through the main air passage, the plastic throttle body having an integrally formed air diffuser disposed downstream of the valve to reduce sound generated within the intake system associated with air flowing past the valve.

57. (Added) An air intake system for controlling the flow of air into a fuel injected internal combustion engine, the system comprising:

a plastic throttle body including a first wall defining a first portion of a main air passage and a valve mounted within the first portion of the main air passage with the valve being movable to selectively restrict flow of air through the main air passage, the plastic throttle body having an integrally formed air diffuser disposed downstream of the valve to reduce sound generated within the intake system associated with air flowing past the valve; and

a plastic intake manifold including a second wall defining a second portion of the main air passage, with the second wall having an upstream end, and the manifold further

including means for mounting the plastic throttle body relative to the plastic intake manifold such that the first and the second portions of the main air passage align with one another, with the plastic intake manifold being downstream of the plastic throttle body, and with the manifold including an EGR inlet adjacent the upstream end of the second wall.

58. (Added) An air intake system for controlling the flow of air into a fuel injected internal combustion engine having a plurality of fuel injectors, the system comprising:

a plastic throttle body including a first wall defining a first portion of a main air passage and a valve mounted within the first portion of the main air passage with the valve being movable to selectively restrict flow of air through the main air passage; and

a plastic intake manifold including a second wall defining a second portion of the main air passage, with the second wall having an upstream end, and the manifold further including means for mounting the plastic throttle body relative to the plastic intake manifold such that the first and the second portions of the main air passage align with one another, with the plastic intake manifold being downstream of the plastic throttle body, and with the manifold including an EGR inlet adjacent the upstream end of the second wall, the plastic intake manifold having an integrally formed air diffuser disposed downstream of the valve and upstream of the fuel injectors to reduce sound generated within the intake system and to reduce upstream flow of EGR gasses past the throttle valve.

59. (Added) An air intake system for controlling the flow of air into a fuel injected internal combustion engine having a throttle valve disposed upstream of a plurality of fuel injectors, the system comprising:

a plastic intake manifold including a wall defining a main air passage, with the wall having an upstream end, the manifold further including an integrally formed air diffuser disposed downstream of the throttle valve and upstream of the fuel injectors to reduce sound generated within the intake system associated with air flowing past the throttle valve.

60. (Added) An air intake system for controlling the flow of air into a fuel injected internal combustion engine having an intake manifold for receiving and distributing intake air to a plurality of cylinders comprising a plastic throttle body including a main air

passage having a plurality of integrally formed plastic vanes extending into the main air passage for reducing noise associated with airflow therethrough.

61. (Added) An air intake system for controlling the flow of air into a fuel injected internal combustion engine comprising a plastic throttle body including a main air passage having a plurality of substantially equally spaced parallel vanes extending into the main air passage, the vanes being integrally formed with the plastic throttle body.

62. (Added) An air intake system for controlling the flow of air into a fuel injected internal combustion engine having a plurality of fuel injectors, the system comprising: a plastic throttle body having a main air passage and a throttle valve mounted within the main air passage with the throttle valve being movable to selectively restrict flow of air through the main air passage, the plastic throttle body having an integrally formed air diffuser disposed downstream of the throttle valve and upstream of the fuel injectors to reduce sound generated within the intake system.

63. (Added) An air intake system for controlling the flow of air into a fuel injected internal combustion engine having a plurality of fuel injectors, the system comprising: a plastic throttle body having a main air passage and a throttle valve mounted within the main air passage with the throttle valve being movable to selectively restrict flow of air through the main air passage, the plastic throttle body having an integrally formed air diffuser having a grid pattern disposed downstream of the throttle valve and upstream of the fuel injectors to reduce sound generated within the intake system.

64. (Added) An air intake system for controlling the flow of air into a fuel injected internal combustion engine having a plurality of fuel injectors, the system comprising: a plastic throttle body having a main air passage and a throttle valve mounted within the main air passage with the throttle valve being movable to selectively restrict flow of air through the main air passage; and an air diffuser disposed downstream of the throttle valve and upstream of the fuel injectors to reduce sound generated within the intake system.

65. (Added) An air intake system for controlling the flow of air into a fuel injected internal combustion engine having a plurality of fuel injectors, the system comprising:  
a plastic throttle body having a main air passage and a throttle valve mounted within the main air passage with the throttle valve being movable to selectively restrict flow of air through the main air passage; and  
an air diffuser having a grid pattern disposed downstream of the throttle valve and upstream of the fuel injectors to reduce sound generated within the intake system.

66. (Added) An air intake system for controlling the flow of air into a fuel injected internal combustion engine having a plurality of fuel injectors, the system comprising:  
a plastic throttle body having a main air passage and a throttle valve mounted within the main air passage with the throttle valve being movable to selectively restrict flow of air through the main air passage; and  
a plastic air diffuser disposed downstream of the throttle valve and upstream of the fuel injectors to reduce sound generated within the intake system.


**Remarks**

Applicant has submitted a number of claims which are believed to be patentably distinguishable over the prior art. Favorable consideration of the application as amended is respectfully requested.

An additional fee of \$3,468.00 is believed to be due for the presentation of 46 claims in excess of twenty with 33 independent claims in excess of three. Please charge this fee and any other fees or credits to Deposit Account 06-1510 (Ford Global Technologies, Inc.) as authorized by the transmittal letter in this case.

Respectfully submitted,

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By \_\_\_\_\_

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